


Teaching vaccination and vaccine: An experience report during the COVID-19 pandemic

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ABSTRACT

Vaccination is a public health action that has a good impact on individual and collective health (MALAGUTTI, 2011). When a person is vaccinated, the population is also protected. The general objective of this paper is to present an experience report on the development of an Investigative Teaching Sequence (SEI) with key concepts about vaccine and vaccination, developed with students of the second year of High School Integrated with Health Professional in the PROEJA modality. The experiment took place in two classes of 50 minutes each, with students from the second year of the High School Integrated to the Health Professional of the PROEJA modality. The classes took place during the second semester of 2020 and remotely, through an instant messaging application WhatsApp group. The topic covered in the classes was Immune System and the content was vaccine and Covid19 vaccine. The theme and content were developed in the classes of the Biology discipline. A total of 17 students participated. And for the development of these classes, notebooks, smartphones and textbooks were used. At the end of the process of applying SEI to the development of teaching by inquiry, we can infer that placing the student at the center of the process is a challenging task and because of two variables that are difficult to manage, which are: 1st - The student away from the school floor has difficulty interacting with his peers and with the teacher and this creates a natural resistance to new ways of learning. 2nd - Innovative actions that take the student out of their comfort zone are always rejected at first.

Keywords: PROEJA, Student protagonism, Teaching by research.

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INTRODUCTION

Immunology is the branch of biology that studies the immune system in all organisms (from invertebrates to vertebrates). This area of knowledge deals with the anatomy and physiology of an individual's immune system that aims to maintain the body's homeostasis in interaction with the environment and with itself. Topics related to immunology are still rarely discussed in basic education classrooms, despite the consolidation of the autonomy of this discipline in relation to others in biology. In addition, there are few studies that address the issue of didactics for the teaching of immunology and its particularities within high school (TOLEDO et al., 2016).

Vaccination is a public health action that has a good impact on individual and collective health (MALAGUTTI, 2011). When a person is vaccinated, the population is also protected. The effect achieved when some people are indirectly protected by vaccinating others is called collective protection or herd immunity or herd immunity. Such immunity happens when a high percentage of the population is vaccinated. However, for herd immunity to occur, it is necessary for the vaccine to prevent the transmission of the infectious agent, as well as to prevent the disease (LEVINSON, 2016). By choosing not to get vaccinated or not to vaccinate their children, there is an increased risk of illness for vaccinated people who have not developed immunity and for others who are not vaccinated (LEVI; LEVI; OSELKA, 2018).

On the internet and especially on social networks, there are people who spread negative information about vaccines, and expose various reasons against vaccination campaigns (LEVI, 2013). The arguments for not getting vaccinated are multiple and of a religious, ethical, political and even scientific nature, in addition to lack of interest or negligence (LEVI; LEVI; OSELKA, 2018).

Basic education plays an important role in the formation of citizens and the construction of individual and collective awareness in relation to health and disease prevention. In this context, teaching should prioritize subjects and activities that provide the individual's awareness of social issues (FREITAS; MARTINS, 2008). High school, the final stage of basic education, aims to consolidate and deepen the contents learned in elementary school, basic preparation for work and citizenship, improvement of the student for ethical training, intellectual autonomy and critical thinking, and development of the ability to relate theory with practice in each discipline studied (BRASIL, 2010).

The teaching of Biology allows the student to understand the relationships between living and non-living beings, proposing and stimulating discussions and debates in the school and social context from the acquisition of scientific knowledge. However, students usually have difficulties in learning this discipline because it has a variety of terminologies and themes at the molecular level, making it difficult to consolidate knowledge, in addition to being disconnected from the students' realities (PEREIRA & MIRANDA, 2017). Teaching in the discipline of Biology is generally based on



technical rationality, where the mere transmission of content is prioritized, without providing the interaction of the teacher with the students, and of the students among themselves in the teaching and learning process (VINHOLI-JÚNIOR & PRINCIVAL, 2014).

For Sasseron and Machado (2017), teaching should provide research, the development of scientific thinking skills that promote creativity in relation to the world. According to the authors, an investigative activity should require and stimulate the creativity of the student so that they can question the reasons for a phenomenon and understand it. In order to assist the investigative process of students, the Investigative Teaching Sequences (SEI) allow the construction of knowledge from the interactions they make with the physical and social environment, with the teacher having the role of assisting in the organization of ideas, guiding and stimulating activities and mediating between the knowledge constructed by the students and scientific knowledge (CARVALHO, 2013).

The general objective of this paper is to present an experience report on the development of an Investigative Teaching Sequence (SEI) with key concepts about vaccine and vaccination, developed with students of the second year of High School Integrated with Health Professional in the PROEJA modality.

METHODOLOGY

The experiment took place in two classes of 50 minutes each, with students from the second year of the High School Integrated to the Health Professional of the PROEJA modality. The classes took place during the second semester of 2020 and remotely, through an instant messaging application WhatsApp group.

The topic covered in the classes was Immune System and the content was vaccine and Covid19 vaccine. The theme and content were developed in the classes of the Biology discipline. A total of 17 students participated. And for the development of these classes, notebooks, smartphones and textbooks were used.

The experience report was carried out from the perspective of a professor who organized, guided and guided the investigative activities of the SEI, in addition to evaluating at the end the acceptance of the investigative approach through the SEI, as a promoter of the teaching and learning of students of the PROEJA modality.

SEQUENCE OF INVESTIGATIVE TEACHING (SEI).

The stages of the teaching by investigation sequence (SEI) were distributed in 2 remote classes of 50 minutes each and that take place through an instant messaging application (*WhatsApp*). The SEI kicked off the problem situations: **What does a Covid-19 vaccine need to have to be effective?** e **In a vaccination campaign, which target audience should be vaccinated first?** After



presenting the problem situations, we will start the entire process investigated, as shown in chart 1 below.

Chart 1: Synthesis of the SEI stages

Stage	Class	Theme/ Concept	Description of the Activity
1st Problematization and Hypothesis Raising	First	Vaccine and Vaccination	Presentation of the problem situations: What does a Covid-19 vaccine need to be effective? In a vaccination campaign, which target audience should be vaccinated first?
			Survey of (hypotheses) answers to problem situations. Guidance for students to research on the key concepts of vaccine, vaccination, vaccines against covid19 and priority public for a possible vaccination and immunization campaign against covid19.
2nd Presentation and discussion on the data found in the research on the key concepts of vaccine, vaccination, vaccines against covid19 and priority public for a possible vaccination and immunization campaign against covid19.	2nd	Covid-19 vaccine and vaccination	Presentation of key concepts by students about vaccine and vaccination. Resumption of problem situations with discussion with students about the relationship between key concepts and problem situations.
3rd Consolidation of the investigative process with the presentation by the students of their solutions to the problem situations		Covid-19 vaccine and vaccination	Presentation of the students' conclusions on the answers to the problem situations in the form of audio and by the instant messaging application (<i>WhatsApp</i>)
		Covid-19 vaccine and vaccination	Presentation of a questionnaire by google form to assess the students' acceptance of the methodology used during classes on vaccination and vaccination.

Source: Author's own.

In the first stage of the SEI, the class was presented with the topic of vaccine and vaccination with two questions:

- ✓ What does a Covid-19 vaccine need to be effective?
- ✓ In a vaccination campaign, which target audience should be vaccinated first?

Soon after, the presentation of the problem situations, the students were heard with their hypotheses about the solutions to the problem situations and then they were instructed to carry out research on the key concepts of vaccine, vaccination, vaccines against covid19 and priority public for a possible vaccination and immunization campaign against covid19.

In the second stage of the development of the SEI, which corresponds to the second class, the students presented the key concepts of vaccine and vaccination. And soon after the teacher resumed the discussion about the problem situations, where the students were stimulated to again present possible and plausible solutions according to the research they did.



To conclude the SEI and the investigative teaching process, the teacher asked the students to present their conclusions regarding the solution to the problem situations presented in the 1st class of the SEI, about vaccine and vaccination. This presentation should be the consolidation of the knowledge acquired by the students during the investigation and the discussions made with the teacher.

In order to know the students' acceptance of the development of the SEI, the teacher will present them with a form, in the form of a google form, for them to respond and thus give their opinion on teaching by investigation with the use of a SEI.

DISCUSSION

The statements analyzed from that moment were extracted from the discursive interactions between the students and the teacher during the application of the SEI and were transcribed and organized in 3 moments that demarcate the way in which the investigative activity was developed in the remote classroom.

The students and the teacher who participated in the remote class were given fictitious names to preserve their identities and maintain anonymity.

1st Moment - Problematization and Hypothesis Raising.

During the first class of the SEI it was agreed with the students that there would be a debate and that they should give their own opinions and without consulting on the web regarding two problem situations:

- ✓ What does a Covid-19 vaccine need to be effective?
- ✓ In a vaccination campaign, which target audience should be vaccinated first?

In the beginning, the debate, as an explanation and raising of hypotheses, took place only about the first problem situation, as we can see in the description of the statements in table 1, below.



Table 1. Description of the dialogues carried out in a *WhatsApp group* corresponding to the classroom.

Characters	Talk
Professor	Guys, today we will have a debate to do during class and we will finish in the next classes. And for today the main rule is: you cannot access the web to seek answers to the questions that will be asked to motivate the debate. I'm going to ask you two questions about a topic that is always appearing in the media, on social networks and even in corner conversations and each one of you should answer with what you know and/or what you think about the question. They can't access the internet to see the possible answers. The 1st first question is: What to have in the future covid19 vaccine for it to be effective, so that it solves the problem of covid-19 contamination??
Maria	Antibodies
Antônia	Antibodies or something that makes our body produce the antibodies.
Josélia	Something to fight the virus.
Paula	Antibodies or something that makes our body produce the antibodies.
José	Antibodies.
Professor	Guys, in the vaccine there will be something to make our body produce antibodies or it will already have the antibodies, both things cannot be had.
Maria	Microorganisms, I guess.
Professor	Should there be microorganisms in the vaccine?
Maria	Yes, professor, I think that the vaccine should have microorganisms to protect us against the virus.
Characters	Talk
Joaquim	Professor, there must be a poison that kills the virus, because then we would have a cure.
Professor	Ok guys. Let us now move on to the second question. When the vaccine arrives, who should be vaccinated first? And why?
Joaquim	The elderly.
Joana	The galley not caught. Because I think that those who have already caught it, already have antibodies.
Maria	Elderly people and children, because they are more fragile.
Josélia respondendo a Joana	But there are people who have already taken it more than 2 times.
Professor	This issue of infection is still being studied, but there are some cases. So guys, does anyone else have any idea who should get vaccinated first?
Antônia	Yes, people who have already acquired the virus have respiratory problems and the elderly, I think, and those who have a chronic disease.
Paula	People who are more predisposed to contracting the virus.
Professor	Guys, we must end the class and you had many hypotheses about the two problems exposed here in the form of questions. Thank you in advance and I'll leave two texts and videos for you to study and in the next class you can say if you've changed your mind or not.

Source: The author's.

During the first SEI class, it can be observed that the students expressed their opinions about the problem situations regarding the vaccine and the vaccination of covid19 and this is easily verified by the dialogues portrayed in Table 1.

According to Borda Carulla (2012), even though students are not able to formulate hypotheses based on scientific knowledge, they should be encouraged to make predictions based on their experiences, to differentiate them from simple guesses. And this was verified during the hypothesis survey, because in the interaction with the teacher, the students did not perform web research on the topic addressed and this is verified by the analysis of the hypotheses constructed and portrayed in table 1.



2nd Moment - Presentation and discussion on the data found in the research on the key concepts of vaccine, vaccination, vaccines against covid19 and priority public for a possible vaccination campaign for immunization of covid19.

In the second class, which took place exactly eight days after the students raised hypotheses, they were asked to explain their ideas about the research they did and the topic they studied.

According to Cardoso and Scarpa (2018), at the end of the investigative process, students should know how to describe, criticize, evaluate, and discuss the topic discussed, and this is verified in the students' explanations in table 2 below.

Table 2. Description of the dialogues on the students' explanations regarding the research carried out on the key concepts of vaccine, vaccination, vaccines against covid19 and priority public for a possible vaccination campaign for immunization of covid19.

Characters	Talk
Professor	Guys, now that we've made the call, what did you discover during your research and investigation?
Maria	A vaccine is a substance that causes the body to produce antibodies.
Antônia	It is killed or weakened virus.
Professor	So, guys, what else? What else does there have to be in the vaccine or rather, what else can there be? I wanted to see the participation of the other students.
José	Proteins of the virus. Vaccines have proteins from invaders.
Paula	The part of the virus that might be used is genetic material, virus protein. The virus can be both active and inactive in the vaccine!
José	Teacher, is it easy to get a vaccine? Is it fast?
Professor	Does anyone know how to answer José, did anyone see this during the investigation?
Maria	Teacher, I saw that it is not easy, because it has 4 steps and it takes 1 to 4 years to do all of them.
Antônia	Guys, what about the covid19 vaccine?
Professor	Yes, professor, about the covid19 vaccine it can have a dead, weakened virus or a piece of it. That's what I understood.
Professor	And why will it heal us?
Joaquim	Teacher, can I answer?
Professor	Can you, say Joana, what have you discovered?
Maria	Professor, reading the articles you left and watching the videos, I didn't see anything about a cure, but I saw that the vaccine will stimulate our immune system to produce antibodies and thus we are protected against covid19.
Professor	Well done folks, but what about who should get vaccinated first? What did you guys discover from your investigation?.
Joana	People who are on the front lines of the coronavirus.
Professor	Alone?
Joana	Non-teacher, the elderly and people with comorbidities.
Professor	Guys, well done. Our problem situations have been solved by you and now you know what can be in a future covid19 vaccine and in the case of a future vaccination campaign who should be vaccinated first. Now let's take advantage of these last minutes of the class for you to answer a questionnaire that I will leave for you to give your opinions on this way of discussing the learning topics of our discipline. OK?
Josélia	Alright, you can send it.

Source: The author's.

In this class of discussion and presentation of conclusions, the students were more objective and brought more elaborate and scientific terms to their dialogues. Thus, it can also be observed, according to Carvalho (2018), that during the development of this SEI, degree 3 of intellectual



freedom was reached, where the teacher proposed the problem, the students presented their hypotheses and sought to do their research and investigations under the guidance of the teacher. And that at the end, the problem questions were taken up by the teacher so that the students could present their conclusions.

At the end of the execution of the SEI, a questionnaire was given to the students with the objective of consulting them regarding the acceptance of teaching by investigation with the use of a SEI. As a result, the majority (55%) gave a score of 8 and 9, where 0 (zero) was the lowest score and 10 (ten) the highest, for the way in which the content of vaccine and vaccination was worked, that is, in an investigative way. But the acceptance score is countered with the opinion on, would they like to see this way of introducing new learning topics being done in other disciplines? If so, which ones? 70% said "no" and only 30% said "yes" and in all subjects.

According to Colenci (2000), when students receive ready-made knowledge, they do not worry about looking for new ways of learning, and this may explain the students' non-acceptance of replicating investigative teaching for other disciplines, as answered by the students.

FINAL THOUGHTS

At the end of the process of applying SEI to the development of teaching by inquiry, we can infer that placing the student at the center of the process is a challenging task and because of two variables that are difficult to manage, which are:

1st - The student away from the school floor has difficulty interacting with his peers and with the teacher and this creates a natural resistance to new ways of learning.

2nd - Innovative actions that take the student out of their comfort zone are always rejected at first.

But, even with the difficulties observed, the investigative process and the student protagonism occurred satisfactorily, as we easily observed the growth and scientific empowerment of the students when comparing the hypotheses and conclusions presented in the first and second classes respectively by the students.

It is not easy to break paradigms, but it is gratifying when, under good guidance, we observe that students have a lot of potential to manage their teaching and learning processes.



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